

Oregon Department of Agriculture
Plant Pest Risk Assessment for
Yellow Floating Heart, *Nymphoides peltata*
2005 (Rev. 2011)

Name: Yellow floating heart, *Nymphoides peltata*, a.k.a. water fringe, fringed water lily, entire marshwort
Family: Buckbean, *Menyanthaceae*

Findings of This Review and Assessment: Yellow floating heart, *Nymphoides peltata*, was evaluated and determined to be a category **"A"** rated noxious weed, as defined by the Oregon Department of Agriculture (ODA) Noxious Weed Policy and Classification System. This determination was based on a literature review and analysis using two ODA evaluation forms. Using the Noxious Qualitative Weed Risk Assessment v.3.8, yellow floating heart scored **67** indicating a Risk Category of **A**; and a score of **21** with the Noxious Weed Rating System v.3.2, indicating an **"A"** rating.



Photo by Glenn Miller, ODA

Introduction: Yellow floating heart and two closely related species are marketed as aquatic garden ornamentals and are well adapted to garden pools, shallow lakes and slow moving rivers. Wherever it has been introduced into the wild, it has proven to be a prolific grower with the capability to dominate shallow lake surfaces. Fish and wildlife habitat, recreational access and water quality are all negatively impacted by dense mats of leaf material. Dissolved oxygen, light penetration, species diversity and fish productivity all decrease in infested waters. Fortunately, the plant is rare in Oregon.



Photo by Glenn Miller, ODA

Growth Habits, Reproduction, and Spread: *Nymphoides peltata* prefers slow moving rivers, lakes, reservoirs, ponds and swamps. It can grow on damp mud and in water depths from 0.5 to 3-4 meters where it forms a thick mat of floating leaves. It is a bottom-rooted perennial with long branched stolons extending horizontally up to one meter or more and lying just beneath the water surface. Stolons develop numerous roots at nodes. The floating, heart-shaped to almost circular leaves are 3-10 cm long on long stalks, which arise from creeping underwater rhizomes. The leaves are frequently purplish underneath, with slightly wavy, shallowly scalloped margins. The flowers are bright yellow, 5-petaled and 3-4 cm in diameter. The flowers are held above the water surface on long stalks, with one to several flowers per stalk

This species reproduces vegetatively through its habit of rooting at nodes and from plant fragments. Seeds are produced in some populations and can remain viable in anaerobic conditions, as are found in lake sediments, forming a persistent seed bank. Seeds in aerobic conditions germinate readily once they have undergone a brief period of cold stratification. Floating seeds are disk-shaped and tend to aggregate into rafts or chains and are dispersed by currents and waterfowl (Cook 1990). They are slightly hydrophobic with marginal trichomes that readily attach to waterfowl aiding dispersal to new habitats. Thousands of acres of small lakes, ponds, lake edges, sloughs and slow moving streams exist in Oregon as suitable habitat for yellow floating heart. Shallow coastal lakes are especially vulnerable.

Yellow floating heart is established in Lake Spokane, Stevens County, Washington, where it dominates many acres of the site. It has also been found in Whatcom and Yakima Counties in Washington. It is found in Arizona, in Trout Lake in the California Sierra Nevada Mountains, and several locations in Oregon in Lane, Washington, Douglas, and Jackson Counties.

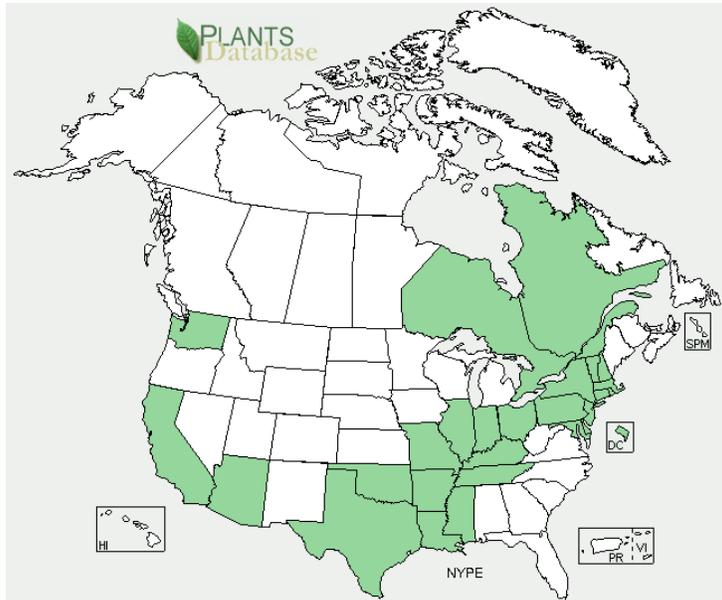
Yellow floating heart can be confused with the native water lilies and escape notice for many years. It usually requires a human element for dispersal so it can be counted on to show up where people have planted it or dumped it. The largest site in Oregon with over one acre net coverage resulted from illegal dumping and escaped identification for many years. There may be private ponds in Oregon that are infested and have not been reported.

Humans are the main culprits with this species. Planting in small ponds and aquatic gardens can disperse this species far and wide. Flood events may then transport plant material downstream. Dispersion by animals has not been a factor in Oregon yet.

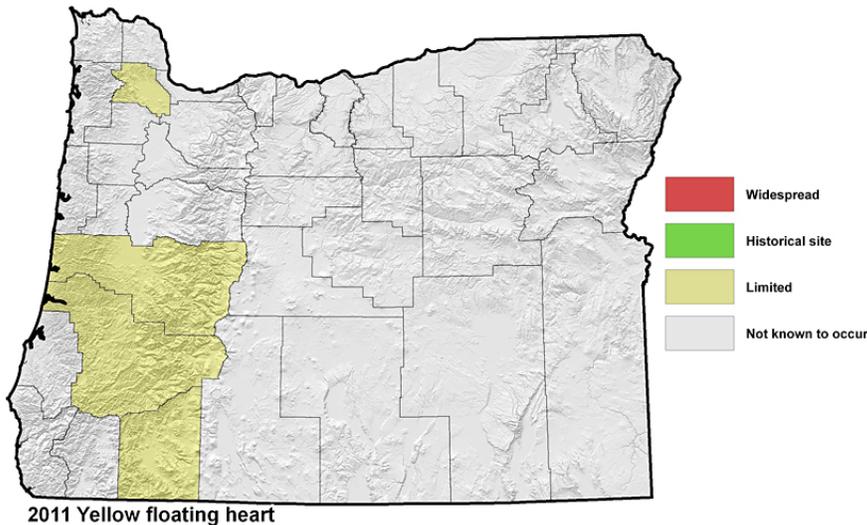
Healthy, clear water bodies offer good rooting opportunities for seeds and stem fragments. Northwest temperatures are mild, even in the winter and pond substrate does not freeze. Most water bodies on the western half of Oregon do not fully dry up and remain moist for newly established plants. Yellow floating heart displays great tolerance for fluctuating water tables and so is not regulated by them (Paillisson 2011). Grazing by mammals is limited and little feeding damage by insects is visible. Lack of grazing pressure insures that this species expresses its full biological potential.

Hardiness Zones: Grows in zones 5-10 (Missouri botanical).

Native Distribution: Yellow floating heart is native to the temperate regions of Europe, Asia and the Mediterranean region.



Yellow floating heart's US population on Plants Database



Oregon's distribution of yellow floating heart on WeedMapper

Economic Impacts: Infested waters become unavailable for fishing, swimming and other aquatic recreation without expensive weed removal. Water bodies can face decreases in dissolved oxygen for fish production and increased populations of mosquitos. Control of this plant can be difficult and expensive. Root fragments and stolons can easily separate in mechanical control treatments to take root again reducing success. The addition of herbicides to waterways for weed control is controversial and may complicate control efforts on larger infestations.

Ecological Impacts: Dense patches, exclude light for native species creating stagnant areas with low oxygen levels underneath the floating mats. Species diversity is reduced, as is fish production.

Control: Control of even small populations has proven difficult in Oregon. Manual removal leaves stem fragments and roots, which quickly recolonize a site. Bottom covers are being attempted to smother infestations but this experiment has not been in place long enough to determine success. Elongation of stolons outside the edge of the covering is a significant issue. Chemical control is effective utilizing aquatically approved herbicides for emerged plants though multiple years may be required for complete control. Both aquatic glyphosate and “Habitat” are effective. Grazing of stolons by nutria can reduce success through the creation of stem fragments that grow into new plants next year.

Noxious Weed Qualitative Risk Assessment Oregon Department of Agriculture

Common name: Yellow floating heart
Scientific name: *Nymphoides peltata*
Family: Buckbean, *Menyanthaceae*

For use with plant species that occur or may occur in Oregon to determine their potential to become serious noxious weeds. For each of the following categories, select the number that best applies. Numerical values are weighted to increase priority categories over less important ones. Choose the best number that applies, intermediate scores can be used.

Total Score: 67 **Risk Category: A**

GEOGRAPHICAL INFORMATION

1) 6 Invasive in Other Areas

- 0 Low- not known to be invasive elsewhere.
- 2 Known to be invasive in climates dissimilar to Oregon's current climates.
- 6 Known to be invasive in geographically similar areas.

Comments: Invasive in temperate zone environments throughout the country.

2) 6 Habitat Availability: Are there susceptible habitats for this species and how common or widespread are they in Oregon?

- 1 *Low* – Habitat is very limited, usually restricted to a small watershed or part of a watershed (e.g., tree fern in southern Curry County).
- 3 *Medium* – Habitat encompasses 1/4 or less of Oregon (e.g., oak woodlands, coastal dunes, eastern Oregon wetlands, Columbia Gorge).
- 6 *High* – Habitat covers large regions or multiple counties, or is limited to a few locations of high economic or ecological value (e.g., threatened and endangered species habitat).

Comments: It is invasive in aquatic systems.

3) 0 Proximity to Oregon: What is the current distribution of the species?

- 0 *Present* – Occurs within Oregon.
- 1 *Distant* – Occurs only in distant US regions or foreign countries.
- 3 *Regional* – Occurs in Western regions of US but not adjacent to Oregon border.
- 6 *Adjacent* – Weedy populations occur adjacent (<50 miles) to Oregon border.

Comments: Found in several locations in Oregon.

4) 10 Current Distribution: What is the current distribution of escaped populations in Oregon?

- 0 *Not present* – Not known to occur in Oregon.
- 1 *Widespread* – Throughout much of Oregon (e.g., cheatgrass).
- 5 *Regional* – Abundant (i.e., occurs in eastern, western, central, coastal, areas of Oregon) (e.g., gorse, tansy ragwort).
- 10 *Limited* – Limited to one or a few infestations in state (e.g., kudzu).

Comments: Known from less than 10 locations.

BIOLOGICAL INFORMATION

- 5) 2 **Environmental Factors:** Do abiotic (non-living) factors in the environment effect establishment and spread of the species? (e.g., precipitation, drought, temperature, nutrient availability, soil type, slope, aspect, soil moisture, standing or moving water).
- 1 *Low* – Severely confined by abiotic factors.
 - 2 *Medium* – Moderately confined by environmental factors
 - 4 *High* – Highly adapted to a variety of environmental conditions (e.g., tansy ragwort, Scotch broom).

Comments: Limited to shallow ponds and lakes or slow moving streams.

- 6) 6 **Reproductive Traits:** How does this species reproduce? Traits that may allow rapid population increase both on and off site.
- 0 *Negligible* – Not self-fertile, or is dioecious and opposite sex not present.
 - 1 *Low* – Reproduction is only by seed, produces few seeds, or seed viability and longevity are low.
 - 3 *Medium* – Reproduction is vegetative (e.g., by root fragments, rhizomes, bulbs, stolons).
 - 3 *Medium* – Produces many seeds, and/or seeds of short longevity (< 5 years).
 - 5 *High* – Produces many seeds and/or seeds of moderate longevity (5-10 years) (e.g., tansy ragwort).
 - 6 *Very high* – Has two or more reproductive traits (e.g., seeds are long-lived >10 years and spreads by rhizomes).

Comments: Produces long lived seeds and stolons.

- 7) 4 **Biological Factors:** Do biotic (living) factors restrict or aid establishment and spread of the species? (What is the interaction of plant competition, natural enemies, native herbivores, pollinators, and pathogens with species?)
- 0 *Negligible* – Host plant not present for parasitic species.
 - 1 *Low* – Biotic factors highly suppress reproduction or heavily damage plant for an extended period (e.g., biocontrol agent on tansy ragwort).
 - 2 *Medium* – Biotic factors partially restrict or moderately impact growth and reproduction, impacts sporadic or short-lived.
 - 4 *High* – Few biotic interactions restrict growth and reproduction. Species expresses full growth and reproductive potential.

Comments: Plant expresses full biological potential.

- 8) 2 **Reproductive Potential and Spread After Establishment - Non-human Factors:** How well can the species spread by natural means?
- 0 *Negligible* – No potential for natural spread in Oregon (e.g., ornamental plants outside of climate zone).
 - 1 *Low* – Low potential for local spread within a year, has moderate reproductive potential or some mobility of propagules (e.g., propagules transported locally by animals, water movement in lakes or ponds, not wind blown).
 - 3 *Medium* - Moderate potential for natural spread with either high reproductive potential or highly mobile propagules (e.g., propagules spread by moving water, or dispersed over longer distances by animals) (e.g., perennial pepperweed).
 - 5 *High* – Potential for rapid natural spread throughout the susceptible range, high reproductive capacity and highly mobile propagules. Seeds are wind dispersed over large areas (e.g., rush skeletonweed).

Comments: Can be dispersed by moving water, perhaps by wildlife.

- 9) 3 **Potential of Species to be Spread by Humans.** What human activities contribute to spread of species? Examples include: interstate or international commerce; contaminated commodities; packing materials or products; vehicles, boats, or equipment movement; logging or farming; road maintenance; intentional introductions of ornamental and horticultural species, or biofuel production.
- 1 *Low* – Potential for introduction or movement minimal (e.g., species not traded or sold, or species not found in agricultural commodities, gravel or other commercial products).
 - 3 *Medium* – Potential for introduction or off-site movement moderate (e.g., not widely propagated, not highly popular, with limited market potential; may be a localized contaminant of gravel, landscape products, or other commercial products) (e.g., lesser celandine, Canada thistle).
 - 5 *High* – Potential to be introduced or moved within state high (e.g., species widely propagated and sold; propagules common contaminant of agricultural commodities or commercial products; high potential for movement by contaminated vehicles and equipment, or by recreational activities) (e.g., butterfly bush, spotted knapweed, Eurasian watermilfoil).

Comments: Not a popular plant in the nursery trade. Cannot be sold in Oregon.

IMPACT INFORMATION

- 10) 5 **Economic Impact:** What impact does/can the species have on Oregon's agriculture and economy?
- 0 *Negligible* – Causes few, if any, economic impacts.
 - 1 *Low* - Potential to, or causes low economic impact to agriculture; may impact urban areas (e.g., puncture vine, pokeweed).
 - 5 *Medium* – Potential to, or causes moderate impacts to urban areas, right-of-way maintenance, property values, recreational activities, reduces rangeland productivity (e.g., English ivy, Himalayan blackberry, cheatgrass).
 - 10 *High* – Potential to, or causes high impacts in agricultural, livestock, fisheries, or timber production by reducing yield, commodity value, or increasing production costs (e.g., gorse, rush skeleton weed, leafy spurge).

Comments: May interfere with fishing, recreation, and property value of lakefront homes.

- 11) 6 **Environmental Impact:** What risks or harm to the environment does this species pose? Plant may cause negative impacts on ecosystem function, structure, and biodiversity of plant or fish and wildlife habitat; may put desired species at risk.
- 0 *Negligible* – None of the above impacts probable.
 - 1 *Low* – Can or does cause few or minor environmental impacts, or impacts occur in degraded or highly disturbed habitats.
 - 4 *Medium* – Species can or does cause moderate impacts in less critical habitats (e.g., urban areas, sagebrush/ juniper stands).
 - 6 *High* – Species can or does cause significant impacts in several of the above categories. Plant causes severe impacts to limited or priority habitats (e.g., aquatic, riparian zones, salt marsh; or T&E species sites).

Comments: Can completely dominate suitable habitat creating loss of habitat for fish, native plants, alters light penetration, oxygen levels in water.

- 12) 5 **Impact on Health:** What is the impact of this species on human, animal, and livestock health? (e.g., poisonous if ingested, contact dermatitis, acute and chronic toxicity to livestock, toxic sap, injurious spines or prickles, causes allergy symptoms).
- 0 *Negligible* – Has no impact on human or animal health.
 - 2 *Low* – May cause minor health problems of short duration, minor allergy symptoms (e.g., leafy spurge).
 - 4 *Medium* – May cause severe allergy problems, death or severe health problems through chronic toxicity, spines or toxic sap may cause significant injury. (e.g., giant hogweed, tansy ragwort).
 - 6 *High* – Causes death from ingestion of small amounts, acute toxicity (e.g. poison hemlock).

Comments: Can significantly increase mosquito populations where canopy is dense.

CONTROL INFORMATION

- 13) 5 **Probability of Detection at Point of Introduction:** How likely is detection of species after introduction and naturalization in Oregon?
- 1 *Low* – Grows where probability of early detection is high, showy and easily recognized by public; access to habitat not restricted (e.g., giant hogweed).
 - 5 *Medium* – Easily identified by weed professionals, ranchers, botanists; some survey and detection infrastructure in place. General public may not recognize or report species (e.g., leafy spurge).
 - 10 *High* – Probability of initial detection by weed professionals low. Plant shape and form obscure, not showy for much of growing season, introduction probable at remote locations with limited access (e.g., weedy grasses, hawkweeds, skeletonweed).

Comments: Plant is showy but may not be recognized as invasive.

- 14) 6 **Control Efficacy:** What level of control of this species can be expected with proper timing, herbicides, equipment, and biological control agents?
- 1 *Negligible* – Easily controlled by common non-chemical control measures (e.g., mowing, tillage, pulling, and cutting; biocontrol is very effective at reducing seed production and plant density) (e.g., tansy ragwort).
 - 2 *Low* – Somewhat difficult to control, generally requires herbicide treatment (e.g., mechanical control measures effective at preventing flowering and but not reducing plant density; herbicide applications provide a high rate of control in a single application; biocontrol provides partial control).
 - 4 *Medium* – Treatment options marginally effective or costly. Tillage and mowing increase plant density (e.g., causes tillering, rapid regrowth, spread from root fragments). Chemical control is marginally effective. Crop damage occurs or significant non-target impacts result from maximum control rates. Biocontrol agents ineffective.
 - 6 *High* – No effective treatments known or control costs very expensive. Species may occur in large water bodies or river systems where containment and complete control are not achievable. Political or legal issues may prevent effective control.

Comments: Aquatic infestations are expensive to control and very controversial. Complete control may not be possible.

Category Scores:

22 Geographic score (Add scores 1-4)

18 Biological Score (Add lines 5-9)

16 Impact Score (Add lines 10-12)

11 Control Score (Add Lines 13-14)

67 Total Score (Add scores 1-14 and list on front of form)

Risk Category: 55-89+ = **A** 24-54 = **B** < 24 = unlisted.

This Risk Assessment was modified by ODA from the USDA-APHIS Risk Assessment for the introduction of new plant species.

1/15/2013 v.3.8

Oregon Department of Agriculture
Noxious Weed Rating System

Common Name: Yellow floating heart
Scientific Name: *Nymphoides peltata*

Point Total: 21 **Rating: A**

- 1) **3** **Detrimental Effects:** Circle all that apply, enter number of circles.
1. *Health:* causes poisoning or injury to humans or animals
2. *Competition:* strongly competitive with crops, forage, or native flora
3. *Host:* host of pathogens and/or pests of crops or forage
4. *Contamination:* causes economic loss as a contaminate in seeds and/or feeds
5. *Interference:* interferes with recreation, transportation, harvest, land value, or wildlife and livestock movement
- 2) **4** **Reproduction & Capacity for Spread:** Circle the number that best describes, enter that number.
1. Few seeds, not wind blown, spreads slowly
2. Many seeds, slow spread
3. Many seeds, spreads quickly by vehicles or animals
4. Windblown seed, or spreading rhizomes, or water borne
5. Many wind-blown seeds, high seed longevity, spreading rhizomes, perennials
- 3) **3** **Difficulty to Control:** Circle the number that best describes, enter that number.
1. Easily controlled with tillage or by competitive plants
2. Requires moderate control, tillage, competition or herbicides
3. Herbicides generally required, or intensive management practices
4. Intensive management generally gives marginal control
5. No management works well, spreading out of control
- 4) **6** **Distribution:** Circle the number that best describes, enter that number.
1. Widely distributed throughout the state in susceptible habitat
2. Regionally abundant, 5 or more counties, more than 1/2 of a county
3. Abundant throughout 1- 4 counties, or 1/4 of a county, or several watersheds
4. Contained in only 1 watershed, or less than 5 square miles gross infestation
5. Isolated infestation less than 640 acres, more than 10 acres
6. Occurs in less than 10 acres, or not present, but imminent from adjacent state
- 5) **5** **Ecological Impact:** Circle the number that best describes, enter that number.
1. Occurs in most disturbed habitats with little competition
2. Occurs in disturbed habitats with competition
3. Invades undisturbed habitats and crowds out native species
4. Invades restricted habitats (i.e. riparian) and crowds out native species

21 TOTAL POINTS

Note: Noxious weeds are non-native plants with scores of 11 points or higher. Any plants in 4.1, 4.2, and 4.3 should not be classified as “A” rated weeds. *Ratings:* 16+ = A, 15 – 11= B
ODA Weed Rating System 8/30/2012 v.3.2

RA produced by Glenn Miller, ODA
2005. Revised 2011

References:

Cook C.D.K (1990), "Seed dispersal of *Nymphoides peltata* (S.G. Gmelin) O. Kuntze (Menyanthaceae)," *Aquatic Botany* 37, no.4 p. 325-340

WA Department of Ecology (DOE). Informational Bulletin. Non-native Invasive Freshwater Plants Yellow Floating Heart (*Nymphoides peltata*). Found at:
www.ecy.wa.gov/programs/wq/plants/weeds/FloatingHeart.html

Missouri Botanical Garden website. Found at www.missouribotanicalgarden.org

New Zealand Web Site: <http://www.boprc.govt.nz/www/green/weed12.htm>

Paillisson J., Marion L. 2011 Water level fluctuations for managing excessive plant biomass in shallow lakes. *Ecological Engineering* 37 (2011) 241–247

Smits A.J.M.; Van Avesaath P.H.; Van Der Velde (1990), "Germination requirements and seed banks of some nymphaeid macrophytes: *Nymphaea alba* L., *Nuphar lutea* (L.) Sm. and *Nymphoides peltata* (Gmel.) O. Kuntze," *Freshwater Biology* 24, no.2 p. 315-326.

Smits AJM.: Van Ruermonde R.; Van Der Velder (1989), "Seed dispersal of three nymphaeid macrophytes," *Aquatic Botany* 35, no.2 p.167-180

Attachment A

